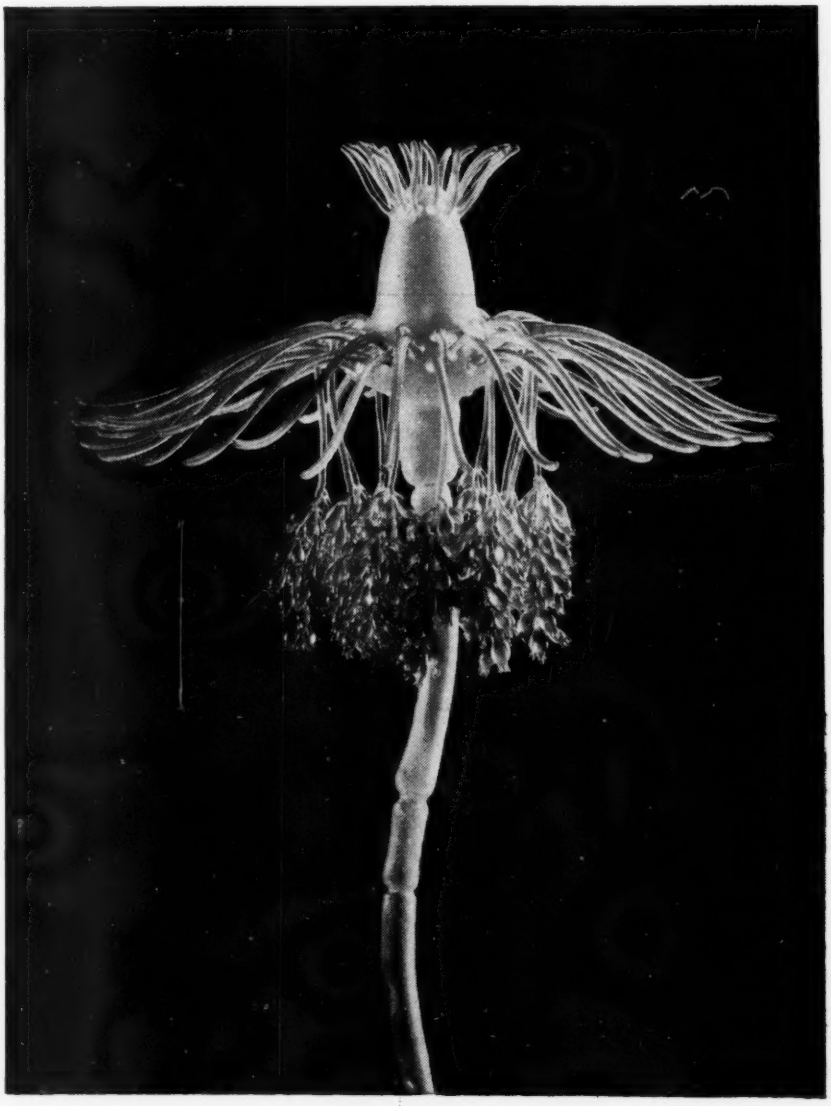
MAIN CURRENTS

IN MODERN THOUGHT



Living Symmetry

See page 54

JANUARY, 1955 VOL. 11 NO. 3

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MAIN CURRENTS IN MODERN THOUGHT

A co-operative journal to promote the free association of those working toward the integration of all knowledge through the study of the whole of things, Nature, Man, and Society, assuming the universe to be one, dependable, intelligible, harmonious.

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MAIN CURRENTS IN MODERN THOUGHT is published 5 times a year in Sept., Nov., Jan., March, and May, to call attention to significant contributions to learning currently being made by workers in the multiple fields into which knowledge has come to be classified. It relates these advances to each other and to the classical and contemporary views of Eastern, European and American thinkers. It is designed to save time for the reader by providing a vantage-ground from which the whole world of knowledge may be surveyed and kept in proportion as it moves toward integration. Its editors assume that the principles of art, the universals of philosophy, the laws of Nature and Man as formulated by science, and the truths of comparative religion, can be orchestrated into a harmonic, meaningful, ethical body of teachings which can and should be made the central core of curricular study in the educative process at all levels of development. In condensing text, square brackets [ ] indicate editorial interpolation. Three dots . . . in the text indicates a word, phrase or passage omitted in the interest of brevity or clarity. Other usages are standard. $3.00 a year. Foreign $3.50. Contributors to MAIN CURRENTS enjoy full liberty of opinion and expression in these pages. Copyright 1955, by F. L. Kunz, Port Chester, New York. to whom all communications regarding MAIN CURRENTS IN MODERN THOUGHT should be addressed. Entered as second class matter April 13th, 1946, at the east office at Port Chester, New York, under the Act of March 3rd, 1879. (Reentered as second class matter November 17th, 1953, at the post office at Port Chester, New York, under the Act of March 3rd, 1879.)

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THE JUNCTURE BETWEEN CREATIVE ARTS AND CREATIVE SCIENCE*

Peter A. Bertocci

Boston University

The Place of Value in Relating Universals to Individual Uniqueness

I

You must bear with me in my treatment of this subject, for I am neither a scientist nor an artist. I am a philosopher with a deep, even paramount, interest in the metaphysics of value, but with a real interest, as well, in the relationship of value to the scientific outlook.

It appears to me that the juncture between science and art is not that between two abstract aspects, two disciplines, but rather the juncture which occurs fundamentally in the life of a human being. We are not all scientists, but every one of us has a theoretic interest in science; we are not artists, but we have a real appreciation of the beautiful and the aesthetic. Therefore it is of interest to me that a man like Darwin should have said that if he had his life to live over again, he would make sure that he read some poetry every day. Why would a carefully observant man like Darwin say such a thing? It indicates to me that he was concerned not only with himself as scientist, but also with his development as a person, a person who lives from birth to death and is trying to fulfill some sort of ideal in his life. One of our major problems today is not to lose sight of the individual person as a whole, in whose life art and science, value and fact, constantly interact to make a new person.

II

I should like to begin by defining, in what may be over-simplified terms, what I mean by creativity: the creativity of science, and the creativity of art. What is it that the creative artist and the creative scientist are trying to do?

First, the creativity of the scientist is mainly concerned with understanding in terms of law, in terms of sequence or routine. The scientist is not so much interested in what the individual thing or event is like as he is in those qualities of one individual which are common to other individuals. The concept of law is fundamental from this point of view, and prediction is one of its important aspects. Therefore, insofar as a scientist is creative, it is mainly in one direction, that of control. His is the interest that wants to know what is going to happen in the future in the light of what is happening now and what has happened in the past. His controlled experiment represents a desire in his own life to see how he can relate himself practically to the environment in whatever field his work lies.

Contrast with this attitude of the scientist—his interest in the universal, in law to the exclusion of the individual—with the attitude of the artist. The concern of the artist is mainly with the universal in relation to the unique individual: this particular color, this particular shape, this particular emotional experience. If one examines any work of art, he finds in it that the artist is trying to express through its shape or pattern something that he holds in common with others and tries to share with them. In other words, the artist tries to express the universal in the particular.

The interest of the artist, then, is not especially in the predictable. He cares rather for the concrete experience of life, for that which is unique, special, and not to be repeated. It is for this reason that the artist is so often accused of having an experience which is purely private.

Second, the scientist is interested in causal sequence, which is the basis of all statements about what will follow "if" such and such are the conditions. There is another interesting and fundamental difference, at this point, between science and art, or two phases of life. The scientist might say something like this: "In all my considerations I am value-free (*Wert-frei*). I am not interested in the value of the cause to anyone; I am not interested in the value of the effect upon anyone. When I make a bomb and show you how to explode it, I *as a scientist,* am not interested in whether or not you hate, fear, enjoy, like, or approve

*An address given at the Orono Workshop of the Foundation for Integrated Education at the University of Maine, 1953.

of the effect of that bomb. As a human being, as a parent or husband, I may indeed be interested. But as a scientist I am simply concerned with the relationship of the effect to the cause, not with its value. Whether I deal with rats or flying saucers, with bombs or with cancer cures, all I want is understanding. It may be that you will prefer to control one of these more than another; if so you will know what to do upon the basis of the information I give you. I, as a scientist, must not be expected to concern myself with the values that eventuate from my scientific discoveries, except the *predictive* value, which is the kind of value all scientists are concerned with."

In contrast to this attitude, the artist is deeply and totally concentrated upon the value aspect of all his work. The scientist would like, if it were possible, to eliminate the personal equation completely. He wishes, for example, that he could replace the human eye by a camera that records accurately and intrudes no interest. In the whole area of art, however, be it drama, painting, music, or what you will, the artist himself is involved, deeply and personally. The nature of this involvement is described in various theories of aesthetics, but however we may elaborate, we must agree that the aesthetic product, or work of art, represents a personal interaction. Indeed, the artist is himself the crucible within which something is taking place, and the work of art which he produces is an expression of that ferment within himself. No artist (and here we must distinguish between artistic and natural beauty) could possibly conceive of himself as a camera. He could not be that objective. Rather, the artist interferes with nature, seeing it in terms of the particular photo-sensitivity that he happens to embody, his particular type of interest.

Thus, the scientist attempts to remove the personal from the scene, but in art the intrusion of the personal is a necessity. It would be very difficult for anyone to understand the Fifth Symphony if he didn't try to interpret for himself what Beethoven expresses in it. (Yet, the further problem comes up. Is Beethoven trying to express himself, or something he thinks is beyond, but related to, Beethoven and to all men, whose conditions he must meet in *his* expression?)

Third, the scientist is not interested in the unique color of the sky (*that* blue) in any other way except as a *sign*. For the scientist, blue is a quality that tells him something about something else. He is not concerned with the qualitative aspect of that blue for its own sake, but only as it aids him to some sort of prediction. But another, more important factor must be added. The relationships in science are trusted especially when they lend themselves to quantitative analysis. It will make a great deal of difference whether a doctor gives a child one amount of penicillin or another; he has to be sure *how much* to give this particular child, who has this particular weight and age. The scientist, therefore, is interested in what we might call *sign values*, in relationships, and especially in those that can be expressed in quantitative ratios. But let me ask: What artist, as such, is interested in the quantity of a particular experience?

The artist, if I may go back to the blueness of the sky, does not care in the least what it may lead to. He simply wants to appreciate, to saturate himself in all that this blueness can do to his psycho-physical being. It is this that I mean when I say that an artist is interested in experience for its intrinsic value, rather than its extrinsic relationships—its quality rather than its quantity.

When the scientist talks about "experience," he means ultimately that his senses have become the test of whatever rational and other processes preceded the sensory perception. His test of hypotheses, in other words, is in terms of sense.

But what happens to this thing we call sense-experience when an artist directs attention to it? I suspect that one of the most important things that artists can do for us is to help us really see and really hear. For example, in the ordinary way I do not look at the sky just with my eyes; I look at it with my concepts. "I see a blue sky; it's lovely, and it means no rain." Yet with what do I actually start? A complex psychological experience, within which "blue" is an aspect. For most purposes, however, my experience of the blue sky becomes simply conceptualized as a blue sky like others I have seen which have meant "no rain." At such " prosaic" times I am not interested in the quality or feeling effect of blueness. I neglect the feeling or emotional quality that the original experience contained, in favor of the practical question: What does this lead to? To use another illustration, at Boston University we have had a grand idea. The class hours begin and end with the ringing of chimes from the Chapel, not merely with the usual buzzer. A buzzer does very well as a sign, but from the point of view of an aesthetic human being, let there be many more chimes in universities to announce the hour's end! Buzzer, bell or chimes are equally effective as signs, but if we want to protect quality in human experience, the aesthetic component of one in contrast to its absence in another becomes an important factor.

To bring our contrast to a point, then, the scientist does emphasize sense, but he uses sense as something that will give him a public check, something one can count, and count on, more than anything like the quality of chimes. For the moment we start dealing with aesthetic experience people become doubtful, murmuring, *de gustibus non disputandum.*

Putting the contrast a bit differently, the scientist feels that he is getting some check for his hypothesis through his senses. Beethoven, too, did not really think he had "got hold" of his aesthetic experience until he was able to put it into sensory form—in his case, in a perfect sequence and pattern of sounds as played by different instruments. A Parthenon, after all, represents the sensory expression of something that is in itself not sensuous. It is a testimony to something intangible, outside of, or beyond, any in-

ductive approach. The artist attempts to stabilize through sensory expression what is, on the whole, a moving but fugitive experience. He feels compulsion to recreate the moment in himself by giving it some sensory form. But it is characteristic of most artists that after they have completed their work, they do not even want to look at it any more. Why? It seems to me that for them the sensory expression is a transmutation. The whole effort of the artist does not lie in merely expressing himself and his feelings (for that is not art), but in the transmutation and control of his feelings. He tries to create something out of the stuff of his total emotional experience: the artistic object.

Whether this particular implict theory of aesthetic production is true or not, it should be clear that while both scientist and artist use the realm of sense, sensory experience plays a different part in two interrelated aspects and moments of our existence: the scientific-practical and the aesthetic-appreciative.

Fourth, we may say that the scientist is disinterested. (Please let us not make the mistake of saying that he is uninterested. A scientist may forget meals and sleep because of his profound interest in his work.) To be disinterested means to try to leave out personal or particular feelings that one may have with regard to the problem under study and the interpretation of the evidence. A scientist may be considering a hypothesis whose consequences he does not like. Nevertheless, if he is disinterested he rivets his attention upon what the evidence calls for, apart from his own personal reactions to it.

III

We have before us the point that has ramifications for a total philosophy of life. It concerns the problem of whether, when we deal with values, we are talking about reality, or simply about private, personal experience. Does the fact that value-experience is "personal" mean that it is not verifiable in any way? The very thing many artists would insist upon is that they are making us aware of a facet of reality which we ought to allow to enrich our lives. The artist characteristically does not tend to say, "I feel this is beautiful," but rather, "It is beautiful," just as we would say of something, "It is yellow." This value (beauty) is open to the scrutiny of a certain kind of sensitive spirit, and is not something the artist has improvised.

Here, as I hinted before, we come upon a major struggle in contemporary philosophy and theory of education. Are we to say that we can trust only publicly verifiable facts, confirmed by a certain conception of objective experience (that is, by a certain type of sense experience), or are we going to say that we believe values and ideals constitute some sort of reality about which it behooves a human being to know?

To put it mildly, at the moment I experience love, am I knowing something about the loved person through the experience? Again, are Dante and Shakespeare talking about something purely local and personal in their dramas, or are they trying to tell us in a particular way something about the structure of the world in which we all live, something about the universal human struggle? Is the Parthenon just an individual effort, or is it an embodiment of the dedication of a whole culture to what it felt was most real and significant in the universe? Does reality impinge upon the artist, does it make itself felt through aesthetic experience, in a way different from the way it impinges upon, and makes itself evident to, the scientific interest? It appears that the artist tries to bring forward in our consciousness a different dimension of reality which has always been there, but disregarded.

The same problem confronts us as we try to interpret another aspect of human experience of value, the moral experience of right and wrong, good and bad. Is it possible to discover anything in this area that is verifiable? Must we say that communism is all right for the Russians, and democracy is all right for us, but that no objective truth is possible about such value-judgments? Nor can we overlook, in this context, the data from the religious area of experience. Note that this religious person also tends to say, "Thus spake the Lord," not "Thus I speak." He may, of course, be wrong, but it seems only fair to him that we keep his kind of data in mind as we try to determine what reality is. We cannot judge moral and religious data "out of hand" from the point of view of scientific "publicity" and "objectivity," and eliminate the aesthetic, moral and religious from careful study in the schools, on the grounds that in these areas we do not have "knowledge."

It seems to me that this is an important consideration in education. Suppose you are on a faculty committee on curriculum, and the question arises as to whether there should be required work in art. There will doubtless be much disagreement, and some will maintain that art is not fundamental for human experience. When it comes to compulsory courses in mathematics and science and psychology, the assent is wholehearted and immediate. But music and theory of value are regarded dubiously. The effect of such thinking has been that we have produced a generation of "educated" (schooled!) persons who do not know what they are talking about when they speak of values. The complaint is frequently heard that the teaching of art and metaphysics is not as good, not as concrete, as it is in the sciences. It seems to me that such a complaint misses the point of art and metaphysics completely. Please do not misunderstand me. I do not want even to seem to say that the sciences are not important to man, for they are of the utmost importance. What I am trying to point out is the fact that our present cultural difficulties are not due to science, but to our misunderstanding of the relationship of the scientific venture to other human ventures.

To return, in closing, to the importance of adequate discussion of valuational and moral problems in edu-

cation, we dare not forget that our trust in scientific discoveries themselves depends on our trust, and the trust of scientists themselves, in moral values. Do you remember the story that is told about Darwin? How honest he was with the facts! When he was developing the evolutionary theory he kept a special notebook for all of the exceptions to his theory. He had courage as well as honesty. Indeed, none of the great developments in modern science would have been possible if its pioneers had not been courageous and honest, as well as imaginative. And loyalty to truth has made martyrs in the field of science as well as in religion. Generosity and magnanimity also characterize the extent to which scientists have felt they must share their insights with one another. Thus have the intangible, non-measurable effects of values played a most important part in the development of modern science.

These few suggestions of the interrelation between the scientific ventures of life, the devotion to predictive truth, and the non-scientific ventures of life, aesthetic, moral and religious, may indicate my main point. We cannot lastingly separate these aspects from each other, and we must seek to develop each critically as well as energetically, lest we lose the meaning of life itself.

Science was born of the belief that reality was essentially uniform. All research begins with an act of faith in the rational ordering of nature. The great success of science has proved that, far from being a superstition, such a belief was a profound and precise intuition of the structure of man. It is because there is nothing fantastic about the cosmos that science has been able to develop. . . Little by little, it perceived the hidden uniformity beneath the complex variety of the surface. It discovered the existence of constant relationships between varying phenomena. These relationships are natural laws: laws of matter, life and thought . . . Investigated with scientific method, they all testify to the underlying order of things.

With a knowledge of these laws, we can predict phenomena or provoke their appearance at will. Such knowledge has made men masters of the earth. But order does not manifest itself so clearly in the whole of nature. Our mind cannot penetrate every realm of reality with equal ease. It excels in discovering the secrets of inert matter and in constructing mathematical abstractions. But, since it loves simplicity, and life is infinitely complex, it finds it far harder to understand living phenomena . . . Perhaps human intelligence has not yet reached the period of evolution when it will become capable of grasping the real under its multiple form . . . But our ignorance should not lead us to believe that order extends only to one part of the world.

Undoubtedly, the success of moral and social life depends on laws as definite, though more complex, as those which relate to the partial pressures of gases in mixtures or to the propagation of light rays. But we do not yet know those laws. . . .

Reality is the most difficult thing for the human mind to grasp . . . Reality has several aspects. They are created either by the technique employed in the analysis of phenomena or by the scale on which these observations are made. The techniques which reveal our spiritual activities, though far less precise, are just as important as those designed to analyze organic ones. Everything we know about the universe and about ourselves derives from two distinct sciences: that of the inorganic world where physics and chemistry overlap and that of life which includes psychology and sociology as well as anatomy, physiology and genetics. The most direct of all analytical techniques is introspection. The examination of the self by the self brings us face to face with something different from anything which has existed since the beginning of the universe . . . The vision of this unique being, arrived at by introspection, constitutes for us the most certain and least variable aspect of reality . . . The laws we need above all to know are not those of the stellar or the interatomic universe but the fundamental tendencies of things as they are revealed to us on our own level by observation and experience. These constitute the aspect of reality which is essential for us to bear in mind in every circumstance of our lives.

—From *Reflections on Life,* by Alexis Carrel, Hawthorn Books, N. Y., 1953, pp. 40-54.

The photograph on the cover, courtesy of the American Museum of Natural History, shows a model in glass of *Tubularia harrimani* (Hydroid), made by Herman Mueller. The hydroids are of the Phylum Coelenterata, Class Hydrazoa. They are mostly colonial, and produce either free medusoids or fixed medusoid buds, which are more or less bell-shaped and bear the sex organs. Minute red or blue spots usually occur at the base of the medusoid tentacles, and although the function of the spots is not proved, there is evidence that they serve as light-perceiving organs.

By reason of their smallness, hydroids are not conspicuous, but they are among the most numerous animals of the seashore. They are found between the tide marks and in shallow water attached to stones, old and living shells, pilings, and other solid objects. The collector who studies the living animals under a microscope has a revelation awaiting him of nature's capacity to produce exquisitely beautiful and perfectly symmetrical forms.

THE ORDERS WITHIN LIVING SYSTEMS

Ruth Lofgren

Foundation for Integrated Education

Reflections in Organisms Of the Laws of Nature

Every living thing, whether plant or animal, has its orderly arrangement of parts and functions interacting to form a whole, a being. We may marvel at the beauty of its design and movement, but it is only when we observe more closely that we begin to see the complexity of the system. Here is a being that moves, feels and reacts, eats, digests, excretes, respires, grows and reproduces and through these functions reveals to us something of the orders of its living.

Let us consider what we mean by order. Schrödinger[1] describes "two different 'mechanisms' by which orderly events can be produced: the 'statistical mechanism' which produces 'order from disorder' and the new one, producing 'order from order.' To the unprejudiced mind the second principle appears to be much simpler, much more plausible. No doubt it is. That is why physicists were so proud to have fallen in with the other one, the 'order-from-disorder' principle, which is actually followed in Nature and which alone conveys an understanding of the great line of natural events, in the first place of their irreversibility. But we cannot expect that the 'laws of physics' derived from it suffice straightaway to explain the behavior of living matter, whose most striking features are visibly based to a large extent on the 'order-from-order' principle. . . .

"We must therefore not be discouraged by the difficulty of interpreting life by the ordinary laws of physics. For that is just what is to be expected from the knowledge we have gained of the structure of living matter. We must be prepared to find a new type of physical law prevailing in it."

The Pauli exclusion principle provides just such a new type of physical law. It has already begun to illuminate the scientific scene. "Prior to that time," Margenau[2] explains, "all theories had affected the *individual* nature of the so-called 'parts'; the new principle regulated their *social* behavior. The first electron, forming a hydrogen atom, can move in any way permitted by the quantum laws of motion. A second electron, if present alone, would settle into the same energetically most favorable state as the first; but *the presence of the first electron forces the second into a different state of motion.* It is as though the second electron 'knew' the first was there even though it does not interact with it by forces of the familiar kind.

"The advance has also led physics to higher ground from which new and unexpected approaches to foreign territory can be seen. Not too far ahead lies the field of biology with its problems of organization and function, and one is almost tempted to say that modern physics may hold the key to their solution. For it possesses in the Pauli principle a way of understanding why entities show in their togetherness laws of behavior different from the laws which govern them in isolation."

Whitehead[3] also sees science as "taking on a new aspect which is neither purely physical, nor purely biological. It is becoming the study of organisms. Biology is the study of the larger organisms. There is another difference between the two divisions of science. The organisms of biology include as ingredients the smaller organisms of physics; . . ." However, according to von Bertalanffy,[4] ". . . biological laws are not a mere application of physico-chemical laws but we have here a realm of specific laws. This does not mean a dualism in the sense that vitalistic forces enter the play in the living. But it appears that the level of biological laws is a higher one, as compared to that of the laws of physics. A third level comprises the sphere of sociology."

Within the levels of biological laws, as Sinnott[5] points out, "There are evidently various *levels* of organization, some of which are subordinate to others in a kind of hierarchy. A cell is one such level, and the processes which go on within it maintain a certain independence; but cells are organized into tissues, tissues are grouped into organs, and organs into individual organisms. This organization may be very loose, as in certain lowly plants where most of the cells are alike and the individual can hardy be distinguished from a colony; the mass may be closely tied together, as in a tree, where there is an indefinite number of leaves and branches but a general pattern for the whole; or it may be very tightly organized, as in most individual animals."

The complex organizing processes within the living systems reveal themselves in seemingly endless structural and behavioral variations. Margenau[6] suggests an approach to the problem: "A science enjoying the richness of data possessed by biology is likely to show a feature which, although present on the lower plane of physics, did not come to a clear focus there. It is the opportunity to represent one given empirical sequence by several different causal chains, and we shall call it the *multiplicity of causal schemes.* One of its simpler instances occurs in the different explanations offered for the same phenomena by thermodynamics and by statistical mechanics. . . .

"In biology, multiplicity of causal schemes is probably important enough to be studied in its own right. It may give rise to levels of explanation, perhaps to an entire hierarchy of explanations, each a causal one, and each at a different stage of organizational integration. Thus there may be encountered a theory framable in terms of molecules and molecular forces, another one in terms of thermodynamic systems, another in which cells and cytological interaction are basic concepts, and perhaps one that speaks of stimuli and responses. If a prognosis can be based on physics, one may judge it to be a very long time before the vertical connections between these schemes are completely understood."

After centuries of scientific inquiry into the orders within the natural world, it would seem that some important pieces of the puzzle are beginning to fit together. New tools, both technical and conceptual, will permit us to deal more effectively with complex systems. Von Bertalanffy[7] proposes a general order in the universe, indicated by the analogies, logical homologies, and explanations of systems from different levels of organization: ". . . a stupendous perspective emerges, a vista towards a hitherto unsuspected unity of the conception of the world. Similar general principles have evolved everywhere, whether we are dealing with inanimate things, organisms, mental or social processes. What is the origin of these correspondences? We answer this question by *the claim for a new realm of science,* which we call *General System Theory.*"

Organism and Environment

A living system has a most intimate relationship with the world around it. There is a continual interaction between the organism and its surroundings that may take the form of food intake and waste disposal, heat loss, absorption of radiant energy, etc. Von Bertalanffy[8] describes this characteristic state as an *open system* (as contrasted with the closed system of physical science): "Living forms are not *in being,* they are *happening;* they are the expression of a perpetual stream of matter and energy which passes through the organism and at the same time constitutes it. We believe we remain the same being; in truth hardly anything is left of the material components of our body in a few years; new chemical compounds, new cells and tissues have replaced the present ones."

One of the great marvels of organization is the ability of living systems to maintain their integrity in this constant stream of matter and energy. Fluctuations in environment and internal state of the organism that might otherwise upset its dynamic equilibrium are compensated to maintain a steady state called *homeostasis.* Cannon's[9] studies on the ways in which the human bodily conditions are controlled emphasize that the local parts usually preserve their own balance but that there are extremely sensitive indicators that bring the nervous system into action in emergency situations when the stability is threatened. He has also shown that the body maintains a large margin of safety which can see the organism through accident or disease.

Growth and Development

Let us examine some of the functions of living systems in greater detail. Metabolism is one of the most basic of these. Lillie[10] introduces the idea as follows: "The difference between living systems — the most highly ordered systems found in nature— and nonliving systems is not that physical action is exact in the one case and not in the other; it consists rather in the fact that in the living system the physical and chemical processes are so combined and coordinated that they lead to the production of an ordered and integrated product of a special and unique type. As we have seen, the high development of synthetic chemical reactions is the most characteristic physical expression of this 'creative' character which so impressed Claude Bernard and Pasteur; and it is because of this unique constructive ability of living organisms that they are able to build up and maintain their complex organizations, which are contrasted so sharply with the comparative uniformity of their environments. Upon this synthesizing property depend all the special vital activities with which we are familiar."

Schrödinger[11] contributes significantly to the subject of metabolism. He asks how living organisms with all their activity avoid the rapid decay into the inert state of equilibrium. The obvious answer, he finds, is in exchange: by eating, breathing, etc. But, he maintains, it cannot be the exchange of material that is essential because one atom of oxygen, etc. is as good as any other of its kind. Neither is it sufficient to say that we feed upon energy since one calorie is worth no more than another. What the organism does feed upon is *order.* This is Schrödinger's argument: ". . . everything that is going on in Nature means an increase of the entropy [disorder—tending toward an equilibrium state] . . . Thus a living organism continually increases entropy . . . and thus tends to approach the dangerous state of maximum entropy, which is death." It can only keep alive by drawing *order* (negative entropy) from its environment. "Indeed, in the case of higher animals we know the kind of orderliness they feed upon . . . the extremely well-ordered state of matter in more or less complicated organic compounds, which serve them as foodstuffs.

After utilizing it they return it in a very much degraded form — not entirely degraded, however, for plants can still make use of it." The plants utilize a most powerful supply of *order* in the sunlight through their photosynthetic activities. Schrödinger's explanation of metabolism clarifies our picture of the natural food chains and the elaborate food requirements of higher animals.

Schrödinger[12] also suggests the chromosomes may be responsible for the orderly events of living systems: "An organism's astonishing gift of concentrating a 'stream of order' on itself and thus escaping the decay into atomic chaos—of 'drinking orderliness' from a suitable environment—seems to be connected with the presence of the 'aperiodic solids,' the chromosome molecules, which doubtless represent the highest degree of well-ordered atomic association we know of —much higher than the ordinary periodic crystal— in virtue of the individual role every atom and every radical is playing here.

"To put it briefly, we witness the event that existing order displays the power of maintaining itself and of producing orderly events. That sounds plausible enough, though in finding it plausible we, no doubt, draw on experience concerning social organization and other events which involve the activity of organisms."

Studies of the electromagnetic fields of organisms promise to provide new insights into the maintenance of steady state and orderly development of living systems. Methods have been developed that make it possible to measure the electrical potentials of a living organism without interfering with its integrity. Burr[13] reports the following observations: (1) Standing potentials were found everywhere in living systems. These steadily increased in magnitude during the process of growth and development (the process of differentiation involved a good deal of biological activity as reflected in the potentials). The magnitude of the standing potential was related to growth capacity and to genetic constitution of corn (the potential of seed of the parent stock was more than four times that of a single gene mutant). (2) Characteristic patterns of potential differences were found in most of the laboratory animals and in man. The right side of a man's body is almost uniformly positive to the left side by several millivolts (this does not seem to be related to handedness). There was a significant relationship between the electrical potential patterns and the forms of the developing embryos. Frog and salamander eggs that were structurally radially symmetrical were not electrically symmetrical. Invariably, the head end of the embryo developed at the point of greatest potential difference. The axis of the embryo coincided with the axis of the electrical field. (3) Aquatic animals maintained voltage differences in the surrounding solution. (4) A growing tree showed daily variations in potential. There were also three sets of cycles suggested by fluctuations seen in records obtained over a period of years: two 6-month cycles, three 4-month cycles, and one of about 28 days which seemed to be most closely related to the phases of the moon.

A developing embryo is perhaps Nature's most extravagant example of ordered process. With predictable accuracy in both design and timing, tissues differentiate and organic functioning is established. Von Bertalanffy[14] explains it as follows: "The basic principle is that of harmonized reaction-velocities: in every cell and every embryonic area many different reactions are going on simultaneously; gene actions and their quantitative harmonization decide which of these processes shall take the lead and thus determine the developmental fate of any given part."

Evolution describes an order in the fascinating diversity of living things that have populated the earth. The theory has been refined by new information that genetics has supplied. The current interpretation is summarized briefly by Von Bertalanffy[15]:

"The theory of evolution, based upon an enormous amount of factual evidence, states that the animal and plant kingdoms have arisen, in the course of geological time, from simpler and more primitive forms to more complicated and more highly organized ones. Genetical experience leads us to accept as a fact that this has happened by way of step-like mutations. Actually, however, we find no evidence either in the living world of today, or of past geological epochs for a continuous transition. What we actually find are separate and well-distinguished species. Even the existence of more or less numerous mutations, races, sub-species, etc., within the species does not alter the basic fact that intermediate stages from one species to another, which should be found if there were a gradual transition, are not met with. The worlds of organisms, living and extinct, do not represent a continuum but a discontinuum."

Form and Activity

The beauty and diversity of living forms have long inspired men to describe and preserve them through drawings, models, photographs, and the collection of specimens. This, however, poses a strange problem, for the universal aspect of living form—its constant activity—cannot be represented in static form and one may unknowingly replace the God by the idol. Thompson[16] expresses his concern with this problem.

"Morphology is not only a study of material things and of the forms of material things, but has its dynamical aspect, under which we deal with the interpretation, in terms of force, of the operations of Energy. And here it is well worth while to remark that, in dealing with the facts of embryology or the phenomena of inheritance, the common language of the books seems to deal too much with the *material* elements concerned, as the causes of development, of variation or of hereditary transmission. Matter as such produces nothing, changes nothing, does nothing; and however convenient it may afterwards be to abbreviate our nomenclature and our descriptions, we must most carefully realize in the outset that the spermatozoon, the nucleus, the chromosomes or the

germ-plasma can never *act* as matter alone, but only as seats of energy and as centers of force.

"The form, then, of any portion of matter, whether it be living or dead, and the changes of form which are apparent in its movements and in its growth, may in all cases alike be described as due to the action of forces. In short, the form of an object is a 'diagram of forces,' in this sense, at least, that from it we can judge of or deduce the forces that are acting or have acted upon it: in this strict and particular sense, it is a diagram—in the case of a solid, of the forces which *have* been impressed upon it when its conformation was produced, together with those which enable it to retain its conformation; in the case of a liquid (or of a gas) of the forces which are for the moment acting on it to restrain or balance its own inherent mobility."

There is so much of form and activity latent within the embryo. The proportions and functioning of the organism develop according to its unique genetic design. To be sure, there is interaction with the environment, but the limits of adaptive response seem to be determined by the nature of the living system. Thompson[17] reminds us of this. "We are accustomed to think of magnitude as a purely relative matter. We call a thing *big* or *little* with reference to what it is wont to be, as when we speak of a small elephant or a large rat; . . ."

Very elaborate processes are carried on by man and those animals that possess highly differentiated nervous systems. Von Bertalanffy[18] describes the progressive mechanization of the organism that accompanies its development.

"Primarily, organic processes are determined by the mutual interaction of the conditions present in the total system, by a *dynamic* order as we may call it. This is at the basis of organic regulability. Secondarily, a progressive mechanization takes place, i.e., the originally unitary action segregates into separate actions, governed by fixed structures. The primary nature of dynamic as opposed to a structural or machine-like order, is seen in fields as diverse as those of cell structures, embryonic development, secretion, phagocytosis and resorption, the theory of reflexes and centers, of instinctive behavior, *gestalt* perception, etc. Organisms *are not* machines, but they can to a certain extent *become* machines, congeal into machines. Never completely, however, for a thoroughly mechanized organism would be incapable of regulation following disturbances, or of reacting to the incessantly changing conditions of the outside world."

We can learn something of the subjective nature of organization. Sinnott[19] sees our being living organisms as providing another avenue of information. "Each of us is *inside* a living organism. The usual method of science is to observe from the outside, objectively. All of our knowledge of plants and animals has come in this way; and, strictly speaking, so has what we know of other human beings. Behaviorism emphasized this laboratory method of studying psychology as all-important. Surely the preferred position which we occupy in our own systems ('between two worlds,' as Spemann says), our ability to *feel* what a complex organism is like, can tell us much about ourselves—and, by inference, about our fellows and even the animals—which could not be discovered in any other way. . . .

"The information thus gained through our own inner experiences is much more vague, however, than that which comes from the laboratory and is far less open to measurement and exact analysis. It depends in no small degree on our particular physiological state at the time it is rendered. Because of this, scientists have always been suspicious of introspection as a reliable basis of knowledge about life and man. For biology to ignore the reports from this inner observer, however, or to deny their importance or even their reality, is to give up any attempt to understand life as a whole. These subjective experiences must ultimately be the concern of the biologist as much as are the actions of genes or the chemical nature of hormones. Biology will need to widen its borders for this purpose and to call into consultation its colleagues in other fields of knowledge, but it cannot disregard such experiences if it is finally to tell us what life really is."

The Larger View

Nature is not an aggregate of separate units but rather an organic whole, coherent and interacting. Lillie [20] sees man as a product of nature who lives immersed in nature.

"Each individual if it acts solely in its character as isolated and self-centered, tries to secure stability and advancement at the expense of others. Nevertheless, what we call 'beauty' — harmony of parts, harmonious interplay of processes, as seen in living organisms or in arts like music — is widespread in nature, although it fails to be realized, or is destroyed, when the individual interests (or what seem to be such) come into irreconcilable conflict. This is by now sufficiently evident; but what should be better known and more widely acted upon is that integration between different individuals, as seen in the mutually helpful relations of the various units in many human and animal communities or even between different species of animals and plants—is as much a factor in biological survival and evolution as is conflict. The avoidance of useless conflict, and the subordination of individual interests to the interest of the whole reality which includes the individuals, would thus seem to be rational aims for all conscious beings; and these aims have the further sanction of religion when the whole is conceived in its character as ultimate value or deity."

Woodbridge[21] inquires into the intelligibility of nature: "In contemplating any history, whether of the animate or the inanimate, none of us escapes the sense of issues and rarely the sense of drama. Nature stirs in us the suspicion of plot or design, of purpose first conceived and then executed. . . .

"The questions are always: What did produce this specific product? What can produce it? . . . Teleology in this sense is both inescapable and the source of intelligibility in historical processes. Indeed, it may be maintained that it affords the definition of what intelligibility is—the discovery of an order or orders in Nature which are not only followed but which can also be expressed in formulas that in their turn can guide practice. Teleology and intelligibility go hand in hand. The laws of Nature are the laws which production illustrates. They make production understandable.

"It should be clear, then, that teleology and mechanism are correlative rather than opposed. They are contrasted in that without the teleology the mechanism would not be discontinued and that the mechanism alone does not reveal what the teleology is."

Bibliography

1, 11, 12 — Schrödinger, Erwin
What Is Life? p. 80-81
Macmillan, New York, 1945 p. 71-72
p. 77

2, 6 — Margenau, Henry
The Nature of Physical Reality, p. 442-443
McGraw-Hill, New York, 1950 p. 416-417

3 — Whitehead, Alfred N.
Science and the Modern World, New p. 105
American Library, New York, 1948

4, 7, 8, 14, 15, 18 — Von Bertalanffy, Ludwig
Problems of Life, p. 157
John Wiley, New York, 1952 p. 199-200
p. 124-125
p. 61
p. 112
p. 17

5, 19 — Sinnott, Edmund W.
Cell and Psyche, University of North p. 34
Carolina Press, Chapel Hill, 1950 p. 56-57

9 — Cannon, Walter B.
The Wisdom of the Body, Chapter 1
W. W. Norton, New York, 1939

10, 20 — Lillie, Ralph S.
General Biology and Philosophy p. 87
of Organisms, Univ. of Chicago p. 208-209
Press, 1945

13 — Burr, H. S.
"Field Theory in Biology," *Scientific Monthly,* March, 1947

16, 17 — Thompson, D'Arcy W.
On Growth and Form, Cambridge p. 16-19,20
University Press, 1952 p. 24-25

21 — Woodbridge, F. J. E.
An Essay on Nature, "Time and p. 194-197
and History," Columbia University
Press, 1940

[The foregoing embodies the major concepts which Dr. Lofgren presented in her address given as part of the series of lectures held by the Foundation for Integrated Education in conjunction with the Staten Island Institute of Arts and Sciences, 1954.]

INTEGRATIVE ASPECTS IN CURRICULA:

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In England Specialization Produces General Education*

Paradoxically, specialization and general education are of great concern on both sides of the Atlantic but for different reasons. In Britain specialization for the average student has come earlier and gone deeper than is the case in America. More recently the Harvard Report, the acute postwar need in England for applied scientists with some university training, and the profound changes in the social structure of the country have produced more questioning of specilization and an increased interest in general education.

[In] grammar school [secondary] education for the first five forms, the program is a general one. The sixth form probably represents the heart of the British system of education. Dr. Eric James, headmaster of Manchester Grammar School, has recently defined the three-fold purpose of the sixth form as "high academic achievement in a fairly limited field," " the training of personality and character," and "to ensure a general as well as a specialized education." The work of the sixth form is generally performed in a different fashion from that of the earlier forms. In his specialty, the student starts to move into the weekly essay and the tutorial technique. Even his non-specialist work can be brought to serve the purpose of general education. One school proposes a course for sixth formers to include Plato, the history of science in the 16th and 17th century, and the Industrial Revolution of the 19th century. The philosophical-historical approach of such a course stresses principles rather than facts.

The British curriculum from sixth form through the university still enshrines specialization for the non-specialist as its ideal, yet the American visitor comes away feeling that the system probably includes as much or more general education in the best sense of that overworked phrase as anything we can offer.

*Condensed from Vol. 80, No. 2037 of *School and Society.*

Before seeking the answer to this paradox, one other aspect of the British system—their examinations—must be included in the picture. From the cradle to the grave, the favorite and predominant type of examination is the essay question, with second choice being the *explication de texte* in languages and history or the problem in mathematics and science. The emphasis is impersonal and on the subject as a field of study. From secondary school on, the student is made to feel that he is responsible for a certain period of history rather than for Professor X's course. Thus, the difference between examinations at the different levels of schooling will be primarily of degree rather than kind; the ordinary paper in Central Certificate history will ask: "What was the Irish policy of Richard II?"; the advanced level will put it: "How wise was the Irish policy of Richard II?"; and the university examiners will ask "Whether clemency or force has proved more successful in the English treatment of Ireland."

Here one is approaching the answer to the original paradox. Only the philosophy underlying British education can give the complete explanation of the breadth derived from specialization. Although the ultimate purpose—the training of the whole man, his body, mind, and character — might coincide roughly with the ideals prevailing in America on this subject, the hierarchy of values within this over-all purpose and the order in which they are to be pursued differ markedly from American practice. In British secondary schools, the first purpose remains character building. In comparison with American public schools, the English ideal is more focussed and organized, and admittedly with correspondingly greater pressures for conformity. In comparison with American independent schools whose goal so often remains simply to get its students into college, the British public schools seem infinitely more aware of the uniqueness and extent of their opportunity and less preoccupied with the sordid details of college preparation.

At the university level in Britain, all the interested parties agree that the first, unchallenged, and primary purpose of undergraduate education remains intellectual and academic: to discover the best minds in the nation and to develop these as far as possible by putting them to work in certain fields of study which have traditionally proved worthy exercise grounds.

Where and how are the goals of general education realized in the British system as described above? In the first place what there is of explicit general education is specifically located in the secondary schools. British public schools and grammar schools provide a more traditional, uniform academic training of a superior quality *on the average,* with stiffer requirements than could possibly prevail amid all the contrasts of our secondary school system. By the time they are 16, let alone 18, all British students who have any hope of going to college have gone further in English, history, science, mathematics, and foreign languages than many American college students ever go.

General education in the British system is thus found not only explicitly in the schools but also implicitly within the specialization of the sixth form through the university. Here one returns to the original purpose of university education in England, which is not to train the specialists (as at first sight might appear to be the case), but to give the student's intellect and character the exercise and training which can best be gained from extensive work in one traditional, mature discipline. Universities, says Dr. Eric James, are concerned "with studies aimed less at the special skills of particular vocations than at the production of men and women possessing wisdom, possessing, that is to say, qualities such as judgment, the capacity and will to make new ventures in thought, and an interest in the perennial problems of man and society." Thus, he goes on to say, one can arrive at the measuring stick for including a subject in the curriculum. Is it related "to the whole body of knowledge by the generality of its principles?" Has it an element of "quality" or "importance" in its subject matter? Does it "extend fully the intellectual capacity" of the most intelligent students? Finally, is it a living and developing study "that will claim the attention of original minds in disinterested research?" That he may experience this training is the reason why the English boy is obliged to specialize from the age of 16 on, not with any idea that he is choosing in all probability to be a classical archaeologist, linguist, historian, or even scientist in later life. This, incidentally, tends to minimize British concern over the fact that the student is choosing to specialize at such a youthful and early age: he is not necessarily electing a lifework but merely an area of study in which he is to be educated. Specialized education as practiced in Britain, therefore, is in large part intended to produce the same result as general education in the United States.

SYMMETRY

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A Discussion Based Chiefly On a Book by Hermann Weyl*

What is symmetry? The word is often used to describe any emotionally satisfying balance of forms and colors. But it also has a precise and profound mathematical meaning. Professor Weyl's little book *Symmetry,* published in 1952, and directed to the reader who is not a specialist in mathematics, explores this meaning, and follows it through the most diverse fields of application. Through the concrete manifestations of symmetry in crystals, in artistic design and ornaments, and in the forms of living things, the reader is led to the formulation of the principle in its most precise and abstract form, and to the fascinating question of what symmetries exist in the fundamental laws of nature themselves.

The square is a simple plane figure which, everyone would admit, possesses a high degree of symmetry. The mathematical analysis of this symmetry begins when we ask ourselves what are the rigid notions which carry the square, as it were, back into itself, effecting merely a permutation of the vertices. Four such motions are the rotations through 0°, 90°, 180°, and 270° about the axis perpendicular to the square, and passing through its center. (We consider the rotation through 360° to be the same as the rotation through 0°, since they give rise to the same permutation of the vertices.) Four more such motions are the rotations through 180° about the two diagonals, and about the two lines which join the midpoints of opposite sides. These eight motions are in fact the only possible rigid motions which permute the vertices while leaving the square as a whole unchanged; taken as a group, they describe the precise nature and extent of the symmetry of a square. A rectangle and a rhombus have a lesser degree of symmetry; the group of motions associated with each of them contains only four motions. Again, the parallelogram has even less symmetry; the group of motions which permute its vertice contains only two motions, namely, rotation through 0° and 180° about the center. On the other hand, a regular polygon of n sides has a group of 2 x n vertex-permuting rotations — a degree of symmetry which, as n becomes large, approaches that of the circle, the most symmetric of plane figures, which is carried into itself by every one of the infinitely many possible rotations about its center.

These simple instances must suffice to illustrate the wealth of concrete examples of symmetry in art and in nature which the reader will find analyzed in Professor Weyl's book. When examined closely, these examples are seen to involve a train of thought which can be vastly generalized, namely, the distinction between the "necessary" and "contingent," between the laws of nature and the actual individual events of nature, between those aspects of a conceptual structure which can be specified in terms of its intrinsic character and those which can only be specified by "pointing." Suppose, for example, that the structure in question is a square. The center of the square can be characterized in terms of the square itself, without reference to anything outside; it is the point equidistant from the four vertices. But, to specify an individual vertex, we must go outside the square itself, as it were; we must relate it to the framework of an individual observer, describing it, say, as the upper left-hand vertex. Similarly, without "pointing," we cannot distinguish between the two diagonals of a square, or among the four sides. All this is precisely due to the fact that, among the eight motions which carry a square into itself, there is a motion carrying any vertex into any other vertex, any side into any other side, and either diagonal into the other diagonal.

From the simple concept of a square, we now pass to our picture of the physical universe—that is, the laws of nature as we *at present* understand them, which are the components of this picture which correspond to the center in the example of the square, that is, which can be defined in terms of the general concepts and laws. And which components correspond to the vertices of the square, and can only be specified by pointing to an individual phenomenon? Things of the former sort will be called "categories," and things of the latter sort "intrinsically indistinguishable." Now, if we use the term "event" for the combination of a point in space and a moment in time, then events are clearly intrinsically indistinguishable from one another; for the laws of nature are (by definition!) independent of particular points in space and time. Again, directions in space are intrinsically indistinguishable (though an ancient philosopher who taught the world to be flat might well have regarded the vertical direction as a "category"). One of the most interesting parts of the book under review is its

* *Symmetry,* by Hermann Weyl, Princeton Univ. Press, 1952. Briefly reviewed in *Main Currents,* Vol. 9, No. 2, p. 67.

discussion of the distinction of left and right. Here again, natural law seems to provide no intrinsic distinction between left-handed and right-handed screws. This can be expressed by saying that the laws of nature are invariant under reflection in a plane—an operation which converts a left-handed into a right-handed screw, and vice versa. If this is so, the physiological fact that the heart is on the left rather than the right side of the human body must be taken to be a contingent or accidental fact rather than a necessity of nature. Another pair of opposites which, as far as our present knowledge goes, seems, like left and right, to present an intrinsic indistinguishability, is positive and negative electricity. However, physicists do not yet understand the very unsymmetric distribution of positive and negative electricity in nature, the former being almost completely confined to the heavy protons and the latter to the light electrons; and it may be that we will eventually have to recognize an intrinsic distinction between the two. Again, geometry suggests that the laws of nature might be invariant under changes in the scale of length — that in physics perhaps, as in Euclidean geometry, two bodies of the same shape but different sizes are intrinsically indistinguishable. But this suggestion is ruled out by the atomic theory of matter, with its fundamental lengths built into the structure of matter itself.

The concept of intrinsic indistinguishability is central to the theory of relativity. Is there such a thing as absolute motion? Or does motion of a body have meaning only in relation to some other body? Though Newton accepted the idea of absolute motion (partly, it seems, because of theological preconceptions), the distinction which is fundamental in his theory of mechanics is not between rest and motion in the absolute sense, but between accelerated and unaccelerated (inertial) motion. The idea of inertial motion is a "category" within the framework of Newton's laws; but different states of inertial motion are, in that framework, intrinsically indistinguishable. Einstein's special relativity theory is precisely that modification of the Newtonian theory which is necessary in order to maintain the intrinsic indistinguishability of inertial motions in the face of Maxwell's laws of electromagnetism.

Through these and other examples, Professor Weyl shows how the principle of symmetry pervades the exact sciences. As in the example of the square with which we began, the mathematical analysis of symmetry always involves a *group* of motions or permutations of the elements of the system being studied, two elements which are connected by one of these permutations being intrinsically indistinguishable. The word "group" is used here deliberately; for it is the technical mathematical term for those families of permutations which characterize symmetry. The theory of groups has become one of the most important of all branches of mathematics. Essentially it is no more than a far-reaching logical analysis of this amazingly fruitful principle of symmetry.

SOURCE READINGS: INTEGRATIVE MATERIALS AND METHODS

PSYCHOANALYSIS RELATED TO SCIENTIFIC METHOD

"Psychoanalysis and Scientific Method," is the subject of a symposium of considerable integrative interest appearing recently in the *Scientific Monthly* (1954, Vol. 79, pp. 293-310). It contains articles by Else Frenkel-Brunswik, B. F. Skinner, Jerome Richfield, and Michael Scriven, and is one part of a five-part conference on the general subject, "Validation of Scientific Theories," held by the AAAS at its December Meetings, 1953.

The general impression left by the tone and content of the symposium is that psychoanalysis is making closer rapprochment with other behavioral disciplines and that criticism of the methods it employs is receding. Of the four contributors, only B. F. Skinner takes the position that psychoanalysis cannot be aligned with scientific procedures. He takes issue with Freud's acceptance of "the traditional fiction of a mental life," and holds that psychoanalysis deals with activities rather than specific behavior of the observable organism. He also believes that Freud misinterpreted both the nature of the act as a unit of behavior and the dimensions of behavior, and that he failed in an operational analysis of the processes of learning. Skinner concludes his article by saying that "Freud appears never to have considered the possibility of bringing the concept and theories of a psychological science into contact with the rest of physical and biological science by the simple expedient of an operational definition of terms."

Scriven, in his comments on Skinner's presentation, differs with the latter's position that hypothesizing in a new theoretical language is never fruitful. He says on this point: "It seems quite evident to me that many of the great steps in the history of science have not only followed the sudden perception of familiar events in a new way, according to a new model — in short, as a result of a new hypothesis—but that they could not have been made otherwise." In commenting on Skinner's insistence on the use of observational terms, he reminds us that our observational terms such as "length" or "response frequency" are also "embedded in a theory, albeit a very well-established one, and every now and again we are awakened

by the discovery that this theory is not inviolable and that we have to change our concept of, let us say, length in a fundamental way, perhaps by introducing a reference to the velocity of the measured object." He goes on to say that "the distinction between psychoanalytic explanation using Freudian language and quoting the correlations between behavior observations cannot be regarded as very fundamental. . . ."

Richfield tries to clear away some of the traditional difficulties by suggesting that "the questions and statements ordinarily involved in discussions of the relationship between psychoanalysis and science are arbitrary, confused, and inadequate." He points out that whether or not psychoanalysis is deterministic has been one of the criteria used in evaluating it as a science in spite of the fact that Heisenberg's uncertainty relationship in quantum physics "has resulted in the judgment that *science* is no longer deterministic." Richfield says that experimentation is possible within psychoanalytic psychiatry but admits that it runs into difficulties and limitations not present in the experiments of the physicist and chemist. He concludes that "most methodological criticism of psychoanalysis has been a futile attempt to shape it more and more into a form that criticism within physics is incessantly changing."

Frenkel-Brunswik makes the same point when she says: "Many of the objections against psychoanalysis have their origin in an overly narrow interpretation of scientific empiricism or of operationism, and generally in a vaguely anti-theoretical attitude." She, too, points out that the physical sciences are traditionally considered "as the ideal model of scientific theory construction and of operational procedure," and that in evaluating other sciences today the "fundamental changes in the conception of theoretical structure that have taken place in the field of physics itself must be taken into consideration." She says that "modern physics and psychoanalysis have in common a turning away from the 'natural' to a 'fictitious' language" and remarks that "the common result of this policy is that a wider and simpler network of interrelationships within observable data is ultimately being achieved."

Fraenkel-Brunswik admits that psychoanalysis has neglected rational as well as social behavior, and believes there is need of further integration with the fields of psychology and sociology. Contrary to the view expressed by Skinner, she contends that "a translation of the psychoanalytic concepts into the terminology of the classical behaviorist's so-called 'stimulus-response' approach . . . has its difficulties and limitations." She feels that psychoanalytic theory "has no rival among psychological theories so far as the range of both its evidence and its explanatory power is concerned," and that its hypothetical assumptions do not place it outside the "bounds of natural science." Rather, it "shares with modern physics the fact that its statements do not lend themselves to the most direct and obvious types of confirmation."

—William E. Galt

THE TEACHING OF PHYSICS

On being awarded the Oersted Medal for notable contributions to the teaching of physics, Professor C. N. Wall of the University of Minnesota blended philosophy, psychology and physics in his reply, given at the 23rd annual meeting of the American Association of Physics Teachers in New York in January 1954, and reported in the *American Journal of Physics,* Vol. 22, Sept. 1954, pp. 364-368.

Professor Wall expressed his belief "that what a physics teacher thinks, or doesn't think, about certain metaphysical problems concerning the theory of knowledge is bound to affect his teaching." The physics teacher should not trust entirely to the commonsense presuppositions absorbed uncritically from his environment, since these often prove to be, in the words of Bertrand Russell, "cocksure, vague, and self-contradictory." He should reflect on the problems and replace his defective notions with ideas that are "tentative, precise, and self-consistent." Professor Wall went on to refer briefly to the history of the theory of knowledge, progressing to some remarks on the theory of learning process. He pointed out that there is both a passive ("absorbing") and an active ("emitting") pole. The learning process consists both in bringing ideas to the student and in drawing ideas out of him. ". . . it is folly for the teacher to neglect either pole. In today's progressive schools, I am told, the little learners are primarily little emitters, whereas in the old red school house days they were primarily little absorbers."

Contrasting the large and the small universities, Professor Wall pointed out the unfortunate tendency of large classes in physics to lose the sense of participation, e.g. in the demonstration experiments conducted down at the front, with the result that the typical member becomes a pure absorber. The university, to fulfill its function, must communicate not only learning itself, but the zest for learning. The large universities, because of the impersonal character of their education, often have difficulty communicating the zest. On the other hand, the small college often fails because it does not encourage research, by which the faculty members can refresh their own zest, or the small college cannot afford to hire a competent faculty in the first place.

Finally, from his experience Professor Wall pointed out what he felt were two common tendencies to weaknesses in the teaching of physics. Firstly, in his enthusiasm for general principles, beautiful in their universality of application, the professor often forgets the necessary role of the minor particulars. The minor particulars of physics have become so much a part of his "everyday" knowledge that he does not realize that they are not common property with the student. The student needs his substratum of particular knowledge developed along with the general principles, else he finds himself unable to apply the general principles to the solution of specific problems. Sec-

ondly, the professor may be overly dependent on the traditional "inductive" development of concepts in physics. In fact, the course of mental development of a student need not, and often does not, correspond with the course of the development of the subject matter as laid out by the physics professor. "If it did, one would suppose that the physics student would first have a clear conception of individual facts which would gradually evolve into a clear conception of fundamental principles. But experience seems to indicate that the actual growth of knowledge in an individual is not one from clear ideas of particular to clear ideas of universals but rather from *vague* to *definite* ideas, whether the ideas concern particulars or universals." —*Ray W. Jackson*

SCIENCE AND CONSERVATISM

Dr. Leonard Carmichael, in the 14th Annual Phi Beta Kappa address delivered at the AAAS meeting, December 30, 1953, in Boston, Mass., and reprinted in *The Scientific Monthly* in June, 1954 (pp. 372-379), discusses "Science and Social Conservatism."

"In society, as in biology, evolutionary development implies stability as well as change. Conservative structures and functions that have worked well and have been useful in the past are the base on which future new adaptive developments are built, both in organisms and in society."

The author explains that if the creation of new plants and animals is the greatest wonder of the living world, the second marvel is surely the amazing genetic stability of organic forms, some of which have remained practically unchanged during many hundreds of centuries of violently changing earth conditions.

Dr. Carmichael discusses the changes in social philosophies and the need for more fundamental study of the real facts about the inborn nature of man if more satisfactory patterns of political life are to emerge and men are to live peacefully and creatively on this globe. "The pendulum of radicalism and conservatism has oscillated back and forth. Today, at last, as we look at these swinging cycles, new, clear lenses seem to be held to our eyes. Some of us begin to wonder whether ideas about man's inborn and acquired nature and about society should not be recognized as important and as having a direct effect on our political and economic institutions."

Human heredity studies show how stable are man's physiological characteristics. The advances have come in better nutrition, lenses for faulty eyes, etc. "Thus, in spite of the effort of many 19th century reformers to pretend that heredity is irrelevant in human affairs, it now again seems that the very opposite may be true. Man's inborn nature may well turn out to be the most important of facts in formulating a sound personal or social philosophy or in setting up stable political and economic organizations.

"Is it not possible that man's wit, cunning, and intelligence may still be able to save the human species . . . ? If this is to be accomplished, must we not recognize that, although man is capable of infinite intellectual and spiritual insights, he is nevertheless at the same time an ancient mammal and must of necessity in many ways live conservatively, if he is to be able to gain real personal dignity and true human freedom through membership in a sound, stable, and achieving society?" —*Ruth Lofgren*

Professor Henry Margenau of Yale takes a look at fireflies and electrons in an article entitled "Advantages and Disadvantages of Various Interpretations of the Quantum Theory" which appears in the October 1954 issue of *Physics Today*. The article is an appraisal of three points of view concerning the interpretation of the quantum theory: (1) Mechanistic Thesis, (2) The Formalistic Thesis, and (3) The Objective Thesis. The author skillfully employs the physical description of the electron as a framework for considering in non-mathematical terms certain fundamental meanings of the quantum theory. With the three contrasting points of view sharply in focus, Professor Margenau proceeds to employ the criteria of Causality, Extensibility and Simplicity from his methodology of science, which is well-known to readers of MAIN CURRENTS, to arrive at an evaluation. The outcome of the test in terms of these criteria is in favor of the Objective Thesis, which considers the *psi* functions of the Schrödinger equation as a part of reality in that they yield, when squared, the probability that the electronic lightning bug in the case under consideration will appear in a specified volume. It is this third point of view which Professor Margenau finds the most acceptable, and he suggests that we grant consciously to probability the function which in fact it already assumes: to serve as the basic determinant of experiences in a real world. These brief words cannot do justice to the philosophical content of this article and its significant content in terms of basic concepts in modern physics. A study of Professor Margenau's paper is strongly recommended.

—*Vernon E. Bollman*

The attention of the reader should be called to the presentation in the *Scientific Monthly* of papers from a five-part conference on "Validation of Scientific Theories" sponsored by the Institute for the Unity of Science, the National Science Foundation, and the American Academy of Arts and Sciences. The papers comprising the first symposium, "Reasons for the Acceptance of Scientific Theories," appeared in the Sept., 1954, issue. The papers from the second symposium, "The Present State of Operationalism," appeared in the issue of October, 1954. The papers from the other three symposia are to follow in subsequent issues. —*Ray W. Jackson*

NEWS AND NOTES

The Foundation for Integrated Education is sponsoring a new adult education course entitled "A Twentieth Century View of Man," to be held at Hunter College in New York City on successive Friday evenings from January 21st through March 25th.

The series aims to explore all the major phases of human nature from the point of view of current scientific information, and to consider man's potentialities in the light of his place in nature and the capacities with which he is endowed. The course will use a specific technique of group participation which will permit full discussion and individual exploration of the subject which has been introduced by an authority on the subject. Subjects and speakers on successive evenings will pose questions of importance for an understanding of the whole man, and all of his creative and conceptual capacities:

Man, the Organizer, by F. L. Kunz, Foundation for Integrated Education: In the human phase of evolution, does the desire for fulfillment become even more important than the desire for survival?

Man's Changing View of Himself, by Ralph F. Hefferline, Columbia University, Department of Psychology: How has the assumption that man has a dual nature (body and soul) influenced his attitudes toward his own behavior and that of others?

Man and His Environment, by Ruth Lofgren, Foundation for Integrated Education: What is it that is stable and ordered when the chemicals out of which we are built are constantly changing?

Man's Liberation Through Development, by Francis S. Woidich, George Washington University, School of Medicine: How has specialization within the human organism led to increased capacities for self-expression?

Man's Functioning Nervous System, by John De Hoff, University of Maryland, School of Medicine: How does man coordinate his actions and arrive at his conclusions about himself and the world in which he lives?

Self-Awareness, the Distinctive Characteristic of Man, by Rollo W. May, Wm. A. White Institute of Psychiatry: How is man able to integrate and unite his biological functioning and his inter-personal relations?

Man's Struggle for Fulfillment, by Lawrence Frank, formerly head of the Caroline Zachry Institute: Why is there so much conflict in man?

Man's Creative Capacities, by Margaret Naumberg, New York State Psychiatric Institute: What are the areas in which man shows rich promise of greater development?

Man's Role in the Natural Order, by Paul Sears, Yale University, Department of Botany: How can man learn to recognize his responsibilities as a conscious being?

Man Within Mankind, by Donald G. Tewksbury, Columbia University, Teachers College: "Am I my brother's keeper?" And if so, why?

As part of a long-range scheme, staff members of the Foundation for Integrated Education are formulating criteria for a study of the school and college curriculum.

Progress reports will appear in these pages from time to time. Meantime one or two compelling promptings for this undertaking might usefully be identified here.

A conspicuous effect of the American educational experience should be the conviction shared by citizens that "the Laws of Nature and of Nature's God" form the primary basis for human life. This proposition was axiomatic to Jefferson and his contemporaries. It has lost much of its meaning and consequently most of its force in application to private philosophy and even (as noticed below) to public affairs, during the last hundred years.

The characteristics of 19th century philosophy of science sustained a mechanistic meaning for the phrase "the laws of nature." By the very nature of mechanistic materialism the ideal component—which introduced the lawful element into natural process—was no longer taken as part of a reality, but as a useful fiction. As nature, in that century, took on more and more a crass material significance, the second part of Jefferson's phrase inevitably became progressively meaningless.

This was disastrous for a country with a secular school system. Ideals which the church and home sought to pass on to children as example and precept were no longer supported in the schools upon their third leg, reason.

That there are laws of nature, in the proper sense of the term law, can now once more be adequately demonstrated with the indispensable help of science. The evidence for a sublimely ordered—and therefore possibly even just—universe, restored to the secular school system, can be counted upon by parents as foundations for whatever final philosophy they may desire to maintain at home.

So much for one basic consideration.

Another, scarcely less significant and certainly quite as urgent, is the breakdown of Constitutional government. For the Founders of the Constitution, a balanced distribution of responsibilities (organic law) was the reflection in jurisprudence of the orders of nature which, if known and obeyed and used, led to

freedom. Since the laws they had now to write out were to be those natural to man (in contrast to the laws of that part of nature which manifests before man appears) it followed that the three chief aspects of human activity which life generally should afford were to be the powers reflected in the Constitution. They are precisely those which any school system must perfect: experiencing, doing, and knowing.

For some time our school system has emphasized the first two, but the third has come far too much to mean not "know why" (which leaves room for ethics), but "know how," which makes for material successes at the cost of cultural and moral exercise. One of the consequences of the basic failure is seen in the increasing usurpation of court functions by the legislative branch of our government in hearings which do not lead to legislation that will increase freedom, and do not actually increase security, their purported occasion. We also see assumption of legislative and court functions by executive departments. This abandonment of organic law in two parts of government has contributed to a terrifying slowing up and breaking down of the third.

The only real—and hence the eventual—cure for this affliction is an education which restores confidence in "the Laws of Nature and of Nature's God," with the powerful, the indispensable, help of science as a cultural mood, in addition to the betterment of science education as a generator of technologies through good technologists. Twentieth century science has restored, just in time, the possibility of such an education. Obviously the restoration involves adjustments in the curriculum which will ensure that the basic skills —language, mathematics, music, social ease, and the like—will be evolved in the child and youth in such a spirit of fun that they will be as great a sport as baseball or tennis. If this is not provided, by right procedures in the earliest years, they will not be available in the later stages of education when they prove essential to the study of natural law as such laws appear not only in matter and energy, but in life and functional form, and in man and his works. Of course they are important in themselves; but they are also means to specific ends. General Motors and International Business Machines (we hear indirectly) are beginning to notice that it is not enough to ensure that education shall provide enough mathematics to keep books for industrial corporations, and to design machines of all kinds. They have about concluded that man has some accounts with the universe to look after, and that the universe has some important designing programs in hand which affect man.

Hence the need of a fundamental curriculum study, based on criteria derived from intrinsics. Obviously the first question is the nature of knowing (thinking), and the second the relation of knowing to experiencing (which rests finally upon feelings of all kinds), and to doing. But other questions of immense reach and powerful purchase also appear at once: What is the place of consciousness of self (not mere perception) in the scheme of nature and in the human constitution? What besides conceptual power, and capacity for recollection and reflection, clusters around this primordial root of all man's powers?

Such being some of the concerns natural to this undertaking, it follows that the study must embrace typical schema evolving in other countries, in England and on the European continent generally, in India and Ceylon and elsewhere in the East, in fact, everywhere without exception. Historical questions also come in. The population of the earth is now the teacher's constituency, not merely as a sentiment or as a neighborhood spirit enforced by the facts of communication. If we want educational support for freedom as a function of natural order, it has to be good enough to be used anywhere. The United Nations as a whole and Unesco in particular have need of this kind of formulation.

It may be useful to summarize here a few of the interests the Foundation sustains along lines congenial to the new study. They include:

An inquiry into the nature of man, to discover the relationships between *education* and *training* at all stages of development.

A continuing study of the advancing frontier of valid conceptual knowledge; especially that which is deductively structured or otherwise naturally organized in clear, communicable terms.

Development of specific methods for solution of the problems posed when science is taught as one of the major *cultural* endeavors of man, in terms acceptable to science.

Original basic research designed to improve the structure of those disciplines not yet as well organized as are physics and chemistry.

The relation of the foregoing to the concepts and educational pursuits of those former societies which have displayed a high degree of integration.

Development of methods whereby every child throughout his life in school may most effectively become cultivated and thus acquire the full cultural heritage of the race.

Adjustments of curricula all along the sequence of the educational experience (as determined by normal personality development) to ensure that integrative concepts give vitality and organization to factual learning, supply motives of adventure for the acquisition of basic skills, and evoke joy in understanding and resolute endeavor toward worthwhile achievement. —*F. L. Kunz*

There are more than eleven thousand quasi-autonomous public school districts in this country. Practically every one of them has felt, to a greater or less degree, the effects of the explosive expansion of population since the early 1940's. Practically every one of them has been forced to build more schools, employ more teachers, and spend more money for public education. As a result of this attempt to cope with the vast increase of children to be educated, most

of these school districts have concentrated on primary and elementary education in schools and most of them have valiantly tried to give adequate educational facilities to this vast new army of recruits to human life.

Under the pressure of the immediate crisis in primary and elementary schools, secondary education—particularly in the Junior High School — has been largely neglected, since High Schools are generally not under immediate pressure because they are just finishing the job of processing the children who were born during the low annual birth rate period of the late depression.

But now the "new crop" of children is already marching forward relentlessly through the elementary grades. In a few years they will be in Junior High School and High School. In the immediate future, therefore, the crisis in American education will have moved into secondary education. Most public school districts have exhausted and even exceeded the limit of their bonded indebtedness for the construction of new schools. The difficulty of housing secondary education adequately is therefore an inevitable crisis unless steps are taken immediately to find sources of the huge amounts of money which will be necessary to meet this need. The training of teachers for secondary education is already a crisis and unless means can be found at once to recruit and properly train the large army of new teachers which will be needed, public education in the secondary schools of this country will be in serious jeopardy.

Many educators of foresight are already gravely concerned over this prospect. As one indication of this, we point to the conference of school superintendents of the State of New York held recently at Saranac Lake, who addressed themselves to the theme "the junior high school as the no man's land of public education."

No one would suggest that the problem can be solved simply by the construction of more buildings and the dragooning of more people into the teaching profession. It is, of course, trite to point to the truth that the program of education is the important factor and all other phases of the problem are essentially secondary. Future buildings must be built as tools for a program. Future teachers will be only as effectve as the program of education they are called upon to teach. Every crisis brings its dangers, but also its opportunities. This coming crisis is no exception. It is imperative now that educators, state Departments of Education and local Boards of Education address themselves to the task of developing a program which will efficiently and effectively equip the men and women of the next generation for life before they make little plans for the housing of classes and the hiring of faculty. It is a case of "seeking first the kingdom of heaven" before we can expect to have anything else "added unto us." If any opportunity ever presented itself to those of us who see the possibilities inherent in a program of integrated education, this most certainly is it.

For all of these reasons, we have been interested to receive from the Board of Regents of the State of New York a report entitled *The Schools We Need—Now and For Tomorrow.* This is the result of five years of study by the Regent Council of Readjustments of High School Education, a group of eighteen lay persons of various professional backgrounds. The report is an honest appraisal of the weaknesses and strengths of secondary school conditions and practices, and makes specific recommendations for the future which are timely and vital if the urgency of the population pressure upon public schools is to be met, and if we are to provide the educational needs of our age with any degree of safety and adequacy.

In the midst of the current hue and cry regarding education, this report is a sane, stable landmark from which we can expect to obtain light for the future tasks, rather than heat which consumes insight and good judgment. *—H. W. Culp*

Worthy of notice by many of our readers who are concerned with or are participating in curriculum planning is *"The 'Great Books' in General Education"* by Ralph P. Rosenberg of Yeshiva University published in the *Yearbook of Comparative and General Literature No. 3* (Chapel Hill, N. C.). This is a survey showing how such representative colleges and universities as Columbia, University of Florida, St. John's College, Wisconsin, and Hunter " . . . are attempting to inculcate one aspect of this ideal (to satisfy the deep need for a cultural heritage accessible to all) in the Great Books part of their General Education programs."

It is well known that "General Education has been a progressive experiment at Columbia College . . . [since] . . . 1919 when John Erskine used the Great Books idea in his seminar in Hamilton Hall." Since 1935-36 a special committee revised the General Education program. "The books in freshman humanities, more than forty in number, range in difficulty and the students, irrespective of this variation, are asked to read sizeable portions at great speed. . . . The course rests on a series of related assumptions: First, that a college . . . should try to produce educated men. Second, that . . . educated men . . . must have learned to feed their souls upon good books, pictures, and music. Third, that the memorizing of labels, catchwords, and secondhand judgments about art and books is not educative in any real sense. And lastly, that to know and be at home with books a man must at some time or other read them for the first time."

The General Education program was introduced at the University of Florida in 1935. All students are required to pursue six basic area courses in the first two years in University College. One of these areas is in the humanities . . . "a course designed to help the student achieve a more mature understanding of his

cultural heritage, an enlarged appreciation of the enduring values which give meaning and purpose to human life, and a philosophy of life adequate for the needs of our age. . .

"St. John's College," Dr. Rosenberg comments, "has become one of the dynamic apostles of an educational mission which has fundamentally rocked American higher education." In its own words, St. John's has "courageously undertaken the larger task which the elective system failed to accomplish, namely to see that the liberal arts assimilate, transform, and pass on the modern subject matter on which they should be at work." This was done in 1937 under the leadership of Stringfellow Barr and Scott Buchanan when the college ". . . cut away from its long-standing open elective system . . . and replaced it with an integrated program of classical and liberal arts studies for all students." This is done "through the reading of the great books of literature, history, mathematics, science, philosophy and religion — the so-called Hundred Great Books [which contain] the shining thread of the great liberal tradition in the Western World."

One interesting aspect of the St. John's program is pointed out by Dr. Rosenberg: "To leave the reader with the impression that these books are read only in translation would be very misleading. In the language tutorials the student is introduced to three foreign languages to gain a reading knowledge as well as an insight into the psychology of language."

Wisconsin, under Glenn Frank, Prof. Philo M. Buck and Dr. Alexander Meiklejohn began its experiments in 1926 and 1927 and used many of the Great Books as literary texts. The experiment was abandoned in 1932 and "apparently it took almost twenty years for the tempers on the Madison campus to cool down; for only in the fall of 1948 . . . was the Wisconsin Program of Integrated Liberal Studies authorized to go into effect." This two-year General Education program ". . . presents essentially a sequence of four semester courses in each of the three major areas of knowledge: the humanities, social studies, and sciences. The Humanities course uses the Great Books selections in four semesters.

"Because it permits of comparison between the two programs . . . [the author concludes his] . . . discussion of the Great Books in General Education with the Humanities Major at Hunter College, an institution which does not subscribe to General Education principles. This Humanities Major "ranges far, wide, and deeply into the main streams of world literature from the very beginnings, including selections from Oriental literature, up to almost the immediate present, while the Great Books program stresses Western literature and necessarily has more breadth than depth. . . . [The Hunter course has] been introduced to enlarge the cultural background of language and literature majors only . . . [it] emphasizes literature as an end in itself; the General Education program looks upon literature as one part of an integrated program, which usually includes the social and natural sciences for the purpose of giving a larger world-view of our cultural heritage. . . . The Hunter College program does not emphasize 'values' as such, whereas the integrated General Education program emphasizes 'values' and attempts to show their relevance to modern life."

Dr. Rosenberg closes his survey with the question, "From where will the necessary instructors be drawn to teach the Great Books courses, if the General Education program continues being introduced into high schools, colleges, and universities?" He concludes by reminding us that "We should prepare our teachers for these Great Books courses at least as carefully and as rigorously as we do our teachers for other courses in the educational curriculum." —*H. W. Cul*

REVIEWS

THREE BOOKS TO ENRICH A SCHOOL CURRICULUM

Continuing our series of reviews of books which seem to have direct pertinence as sources of cultural and integrative enrichment in a school curriculum, we note here three which supplement those which we have previously mentioned.

The Story of English by Mario Pei (J. B. Lippincott Co., Philadelphia, 1953, 352 pp., bibliography, word list, index, $5.00) is an excellent and easy-to-read source regarding our language, its past, its present, and its future. It is to be hoped that more works of this sor (and possibly graded text-book adaptations of thi material) may soon be available to aid teachers in mak ing the study of English come to life for their student

It is a paradox that, after thirteen or seventeen year of "English" courses, we are still graduating masses o students who know relatively little or nothing of thei native language. In studying our language and in usin it, both teacher and student should be aware of th dynamics which enter into its change, into the buildin of the world's most extensive vocabulary (chapters VI

and IX), the extensiveness of naming which is a hallmark of our language (here students should be on familiar ground, with baseball and other sports), its geography, its use and abuse as written and spoken tools, etc.

We are tempted here to expand upon the current disappointment with the results of all of our teaching of English. We shall refrain from so doing, while we urge teachers, administrators and curriculum-builders to refer to this delightful book for inspiration and suggestions for improvement and vivification of their teaching.

The Main Stream of Mathematics, by Edna E. Kramer (Oxford University Press, N. Y., 1953, 309 pp., General References, Index, $6.00) is a volume which should be of as much aid to teachers of mathematics as the previous one should be to teachers of English. For the same deadliness pervades this subject as permeates spelling and grammar.

It is psychologically impossible to achieve more than passing skill in routine mathematical procedures if mathematics from arithmetic to the higher algebras is taught merely *as* a skill without any reference to nature, philosophy, history, to culture and to the warmth of human living. This book provides much of this latter material with which an alert teacher can profitably enrich more prosaic curricular offerings.

The scope of the volume is best reviewed by a quotation from the author's preface: "A special feature of the book is the historical or legendary material, which has been included both to show the evolution of science, and because the facts are so full of surprises. There are few who do not know Einstein as a mathematician, but how many have heard of Hilbert? Again, most laymen have never read a word about the Hindu mathematicians whose influence on our daily lives is probably greater than that of Henry VIII or Napoleon. In a few instances we have combined fiction with fact in narrating incidents. The men of mathematics come alive in association with their surroundings. It is surprising that they have almost never figured in historical fiction.

"We shall, of course, discuss ordinary arithmetic and algebra. Our objective, however, will be to examine their relationship to other systems of numeration and symbolism, systems that have some factors in common with the everyday species but diverge in ways rendering them more suitable for certain scientific applications. Geometry will be considered at first in relation to art and the inspiration of art—nature itself—leaving the notion of pure geometry for a latter chapter. Trigonometry as a tool can stand some de-emphasis in favor of its characteristic of mirroring the eternal periodicity of nature. Statistics is no longer glorified bookkeeping but a means of testing hypotheses, controlling industrial processes, and describing the nature of matter. Calculus concepts, freed of manipulative detail, are within the reach of all. Relativity is a natural climax to mathematical discussions . . . Finally, we must touch on the major issue of mathematical philosophy—the infinite, with its intriguing paradoxes and its inevitable association with the most profound problems of modern mathematics. . ."

As a "New Year's greeting," or wish, to the teachers of mathematics and their long-suffering and often-bored students, we pray that the breath of life will begin to stir among them—by virtue of the approach and the material of this book.

The average student gets his history and his culture in a lump embedded in which lies an amorphous thing called "economics." When economics *per se* is brought into focus in the classroom the student is seldom, if ever, given any sense of the human forces behind economics and the philosophers who, in a variety of social and physical contexts, have produced such a welter of economic theories. Alas, also, most students get very little economic philosophy until they either elect a college course in economics or are required to take it by the powers that be!

In a world which is torn between ideologies bearing names associated with theories of economics, it should behoove every teacher to prepare himself with material which can assist his students to view the subject as part of the cultural wholeness of his heritage. We highly recommend, therefore, *The Worldly Philosophers* by Robert L. Heilbroner (Simon and Schuster, N. Y., 1953, 319 pp., Guide to Further Reading, Index, $5.00), in which are to be found well-written summaries both of the economic theories and of the lives and social milieux of the major thinkers in economics.

We can stress the importance of much of this material for every classroom by the closing words of the author: "Much of the teaching of the great economists no longer applies. And yet, it has not gone entirely out of date. For the great economists gave men an understanding of the world which has become part of our everyday philosophy. What they taught us was that the world was not just an unrelated confusion but a concatenated process, not just happening but developing. They gave us an understanding of our environment so that we might profit by it more fully; they gave us an understanding of our past so that we might better comprehend the process which is sweeping us into the future.

"We shall need their insight as we progress into the future. As the control of our destiny devolves increasingly upon ourselves, we shall have to make choices—desperately important ones—among the counsels of the present. It is from the scope and wisdom of the economists of the past that we must reap the knowledge with whch to face the future."

Are any High School teachers reading this?

—*Harvey W. Culp*

MUDDLING THROUGH DILEMMAS WHICH NEEDN'T ARISE

A penetrating observation is attributed to the American philosopher, Artemus Ward. He pointed out that it is not so much what people don't know which makes for trouble, "but what they do know which ain't so."

The Tarner Lectures are directed to this problem. They were endowed at Cambridge University to provide discussion of the "Philosophy of the Sciences and the Relations or Want of Relations between the Different Departments of Knowledge."

The lecturer for the twelfth series was Gilbert Ryle, Waynflete Professor of Metaphysical Philosophy in the University of Oxford. The resultant book, *Dilemmas,* (Cambridge University Press, 1954, 119 pages, $2) contrasts in style with the two exhaustive and earnest en-

deavors in this series previously published. (*Scientific Explanation*, by R. B. Braithwaite, reviewed in MAIN CURRENTS, Vol. 10, No. 2, p. 43, and *Biology and Language*, by J. H. Woodger, reviewed in Vol. 10, No. 3, p. 68.)

Professor Ryle is wholly delightful, making clear that wisdom is a pursuit, as he deals with fatalism, one of Lewis' paradoxes, the world of science and the everyday world, technical and untechnical concepts, perception, and formal and informal logic. His purpose throughout is to show how these dilemmas, which really distress us in life and thought, often arise because we try to apply two mutually inconsistent concepts, or habit and concept, to a given situation without noticing that the dilemma is inevitable because of the incompatible assumptions and structures.

All this is done directly, at the level of general communication, with a sustained spirit of the immediacy and reality with which philosophy and metaphysics enter from their roots into daily life, and not from their superficies. To achieve this directness Professor Ryle uses homely but searching examples, and he traces his argument down in each instance until he can reduce the essence to something perfectly plain. For example, in the course of a close examination of essentials of the formal logic of Aristotle, the Megarians and Stoics, and of Bertrand Russell, displaying the utility thereof, and the larger needs of the philosophy, he ends up (p. 114):

". . . But now we have learned, what we should have foreseen, that questions which can be decided by calculations are different, *toto caelo* different, from the problems that perplex. There is one person to whom it is impertinence to give the advice that he should keep one foot on the kerb—and that is the pathfinder. Kerbs cannot exist where the road is unmade, and roads cannot be made where the route has not been found.

"You can guess for yourselves the abusive nouns which are now liable to be interchanged. 'Muddler-through,' 'romantic,' 'anti-scientist,' 'hunch-rider,' 'litterateur' and of course 'Platonist' come from the one side; from the other side there comes 'Formalist,' 'compyter,' 'reductionist,' 'pseudo-scientist' and, of course, 'Platonist.'

"As might be anticipated, neither party is right, though both are more nearly right than the appeasers who try to blend the operations of the one party with the operations of the other. The drill-sergeant is wrong who thinks that soldering consists in going through the motions tabulated in the drill-book. The *franc-tireur* is wrong who thinks that soldiering consists in outbursts of amateur gunmanship. But neither is so wrong as the scenario-writer who represents fighting soldiers as heroes going berserk in close column of platoons."

—*F. L. Kunz*

AN EXCITING PRESENTATION OF THE UNIVERSE'S DESIGN

One of the finest things to happen to us in the Foundation just before Christmas was the receipt of a review copy of Dr. Fritz Kahn's *Design of the Universe, The Heavens and the Earth* (Crown Publishers, Inc., N. Y., 1954, 360 pp., Index, $5.00). Of this book the publishers say on the dust jacket that "Dr. Kahn has a rare gift of presenting complex ideas—even including relativity and atomic fission—in a way that is scientifically accurate, yet more exciting than a good mystery story. His series of illustrations, prepared especially for this book and produced in large size, adds dramatic clarity to the panorama . . . The author, with experts in each field who checked every statement, has brought together the truths and principles of the natural sciences in a way that has never before been achieved." Dust jackets are not places where one usually looks for understatements. But in this case the publishers have presented one of their products with a restraint which, while noble, is wholly uncalled for. Here is a book whose arrival should be signalized with dancing in the streets.

Another quote from the dust jacket describes the book and its purpose: "It is the story of the universe—what it is like and how it came to be, the earth's place in the universe and man's place on earth. The intelligent man today has an obligation to learn all he can about the universe, to gain at least a general understanding of its facts and theories. For this is a great age of science, and the lives of every one of us, our families and the generations to come depend on how intelligently we apply and react to the amazing new discoveries and developments of our time." Here is integration not only of all of the physical sciences, but also of philosophy, history,—and art. The art work in this book is, of itself, ample reason for its being on the shelves of every school library. The artists have not only done an excellent job with the usual type of "factual" illustration but they have done a truly amazing piece of work in portraying action, process, and hypothesis. The photographs which accompany the drawings and text are also well-chosen. We know of no better "picture book" of modern science than this.

The author plunges directly into "The World of Modern Physics" and starts the reader on his way with space and time in classical and modern physics, moves on to "Matter and Energy in Classical Physics" and thence to "Matter in Modern Physics," which brings the reader into contact with the concepts of modern relativity and field theory by the time he has reached page 38! As examples of how Dr. Kahn has beautifully interwoven and integrated history and philosophy, let us quote the closing paragraph of the second chapter ("Space and Time in Modern Physics"): "Thus time and space, past and future are interwoven into a deceptive fabric. Reality is, as the Hindus symbolized it, a 'Veil of Maya,' a veil of delusion; we cannot report events in different systems of reference with our popular expressions 'now' or 'today' or 'before.' Our picture of the universe is not purely fictional but neither is it 'objective.' There is no such thing as truth in human science. That is why Alfred Whitehead said: 'Exactness is fake.'"

Early in the next chapter ("Matter and Energy in Classical Physics") we find the following statement: "The peoples of India and China were the first to develop a coherent theory about the relationship of space, time, matter and events. It is surprising how much their early philosophies, first conceived some 5000 years ago, resemble our modern concepts. . . In Brahmanic thinking, as in modern physics, matter and energy are identical. There is one universal 'mass-energy' which plays as dominant a role in ancient Hindu philosophy as does God in the Bible. Named Brahmã, it is regarded as the one universal divine agent. Brahmã is the same panthe-

istic concept of god and nature as the One and All of the Greek philosophers, the *Ens Unum Eternum et Infinitum* of Spinoza, and Goethe's concept of the all-embracing God-Nature." After quotations and a brief discussion of this philosophy, the author refers to the Chinese veneration of universal mass-energy, Tao, and concludes these three pages with the words: ". . . The Hindus and the Chinese, neighbors in geography and brothers in philosophy, provide an illuminating example of the effect of philosophy and science on the attitude and thereby on the historical fate of nations."

Part Two of the book, "The Atom," begins, of course with Democritus. But with this difference: *"Tomos* is a Greek word meaning cut. Atom means the non-cuttable, the indivisible." What could be simpler, more direct, more related to the student's cultural and linguistic heritage? Here, too, your reviewer wishes he could quote the entire first page of this Part. Atoms are everlasting, they "fly together like doves at feeding time. And just as doves fly apart after they have fed, nothing really perishes; instead, the atoms disperse." For sheer delight and exciting beauty one should read on about the atoms in one's breath and about the atoms of carbon in the printer's ink on the page! Or again, in discussing the emptiness of atoms, "If there were a creature living on the electron of an iron atom in the middle of a steel girder, it would peer out into its universe and compose poems on the 'awesome vastness of cosmic space' . . . Only a billionth of the seemingly solid wall consists of matter; the rest is space."

Lucidly, concisely, and beautifully, the text progresses through chemistry to conclude: "Until our own day, chemistry was a gamble. Chemists tried out combinations and hoped, among hundreds of attempts, to hit upon a useful one. With the discovery of electrons and electron vacancies, chemistry is in the process of changing from a gamble, in which atoms were used as stakes, to an exact science with predictable results. Yesterday, alchemy; today, chemistry; tomorrow, electron-dynamics."

Fourteen pages present "Radiation" and another forty beautifully illustrated pages take us through the nucleus and nuclear fission. But who would expect an author to be so integrative and so skillful as to dare to begin Part Three of such a book as this by making a transition from microcosm to macrocosm by counting the red blood cells in the average human and the structure of the hemoglobin molecule thence, and then progressing, by a space ship of fantasy (piloted by a crew of non-mortals), into the reaches of inter-stellar and inter-galactic space? But, before we are allowed to view the cosmic wonders, Dr. Kahn refers to the theme of the conceptual power of the human mind by reminding us that ". . . When the apex of urban civilization is reached, however, a more realistic *Weltanschauung* replaces this mythological naivete [of primitives]. So the priests in Babylon and Egypt and, a thousand years later, the Greek philosophers recognized the true nature and relation of earth, moon and sun."

It should come as a shock to many to learn that "Thales of Miletus . . . correctly predicted an eclipse of the sun on May 28, 585 B.C." Thus, we enter Astronomy and Cosmogony and, after presenting the various theories with which modern science now seeks to unravel its current mysteries, we return to a discussion of the planets. We are glad that the instrument makers, the mathematicians, and others who have helped to sketch in the picture of man's concepts of the cosmos have not been neglected. Man and his magical mind are never far from the author's consciousness: "An amazing sidelight on the mystery of the ring of Saturn is that it was known to the ancient Maoris of New Zealand. Since it is biologically impossible for naked eyes, no matter how sharp, to perceive the ring, we are led to wonder how these aborigines received their strange knowledge . . . To attack this puzzle, we must first rid ourselves of any prejudice that only the so-called literate peoples are intelligent or productive. The difference between literate and non-literate races is not one of intelligence, but rather of a way of life . . . Who knows whom the Lord of the Universe will welcome with greater delight: those who come to his throne, bearing in their hands dissertations on the periodicity of the cepheids, or those who offer only a garland of myths about the milky band in the night sky."

Having taken his readers from the realms of the microcosmos through the macrocosmos and the mega-galaxy, Dr. Kahn concludes his section on astronomy with a touch on the natural feeling of being ". . . so lost, so minute, that we want to hide our head like a child under the covers during a lightning storm" . . . with these words:

"We cannot provide the answer. But we are convinced of the basic truth: that the universe is an indivisible entity. There is nothing 'great' and nothing 'small,' nothing in the millions of galaxies that does not obey the natural laws governing our minute planet. Nowhere is there a sun shining on its planets with more maternal warmth than ours has for us. Nowhere is there a crystal more symmetrical than the diamond, nowhere a tree whose structure fits its environment better than the tree on the lawn. Mother-love is the same everywhere and never greater than the love with which a cat defends her kittens. Form may differ and size may vary, but the innate nature of things is the same everywhere. We find nothing in other worlds that does not or could not exist on earth.

"Earth may be called nothing, but Earth is also everything."

The final section of the book is devoted to the Earth and nowhere has this reviewer seen a better, more lucid, or more exciting presentation of geology, meteorology, and oceanography. And what better way could an author close a book such as this than, once again, to point to the place of the mind of man in such a universe: "In many respects the appearance of man is remarkable, but especially so in one less obvious respect—the awakening of intellectual reflection. Creative mass-energy, after billions of years of evolution, becomes in man's brain conscious of itself and of the wonder of the world. Philosophy and science are born and the riddle of the universe is pondered—at first through Oriental contemplation and the Bible's concept of universe and man, then through Greek philosophy, once more by the efforts of Newton to construct the 'Frame of the System of the World,' and latest by combining relativity and quantum mechanics, the cyclotron and the Palomar Mirror to devise our modern Design of the Universe."

And may there grow up teachers who can teach, inspire, and integrate after the fashion which Dr. Kahn has demonstrated in this book! —*Harvey W. Culp*

A VALUABLE REFERENCE WORK ON HINDU SOCIAL ORGANIZATION

A second edition makes available a valuable reference work on Indian social thought: *Hindu Social Organization,* by Pandhari-Nath Prabhu (The Popular Book Depot, Bombay, 1954, 364 pages, bibliography and index, Rs. 20). With careful scholarship Dr. Prabhu has extracted and condensed major points in the works of chief Indian traditional authorities—the Vedas, Manu, Yajnavalkya, Kautilya, Mahabharata and Ramayana (see his bibliography)—and grouped these under seven principal heads: The bases of human relations, and the problem of existence and its implications; the social psychology of the system of the four ashramas (stages of life of the individual); the social psychology of education; marriage; the family; attitude toward the woman and her place in the society; the four varnas (literally, "colors," more freely, "castes").

He has also drawn upon a wealth of western writers. This ensures that the reader finds pertinent sources from modern analytic scholarship cited in the text, point by point. The author is also conversant with those now aged Indian writers, such as Babu Bhagavan Das, whose erudition in Indian texts enabled them to bring through to our times the essential connections of Indian social thought with Indian psychology, philosophy, and metaphysics. Since this connection is the vital element which was so often neglected or actively impaired in the university's treatment of Indian social thought, the reader is indeed well served. In fact we are not acquainted with any work of comparable value in this field.

—F.L.K.

FOR SCIENCE OF TOMORROW: ACCENT ON FORM

Accent on Form, by Lancelot Law Whyte (Harper & Brothers, New York, 1954, 198 pp., $2.75) constitutes Volume Two of the series, "World Perspectives," planned and edited by Ruth Nanda Anshen (Volume One was entitled, *Approaches to God,* by Jacques Maritain). This volume, which is sub-titled "An Anticipation of the Science of Tomorrow," is stimulating and provocative for the scientist and the thoughtful layman of today because of the questions it raises and the insights into a possible development in concepts which may come at any moment.

The author, whose most recent book was *The Next Development in Man,* continues in his role as both scientist and prophet. The work begins with a chapter whose theme is "Mankind is capable of acquiring understanding but is still abysmally ignorant." Here we find clearly stated the case for concepts. The author demonstrates splendidly that our way of looking at the world is in essence the human phase of the creation of reality, for it is in terms of the conceptual frame of reference within the mind of man that the world of matter, space and form assumes its "reality."

Those who are perplexed in the face of the ambiguities, the unanswered questions and the challenges which one finds close in upon the frontier of that which is now known, will find stimulation and a suggestion of hope in the author's thesis that in the form of things may be found clues to the answers which he seeks.

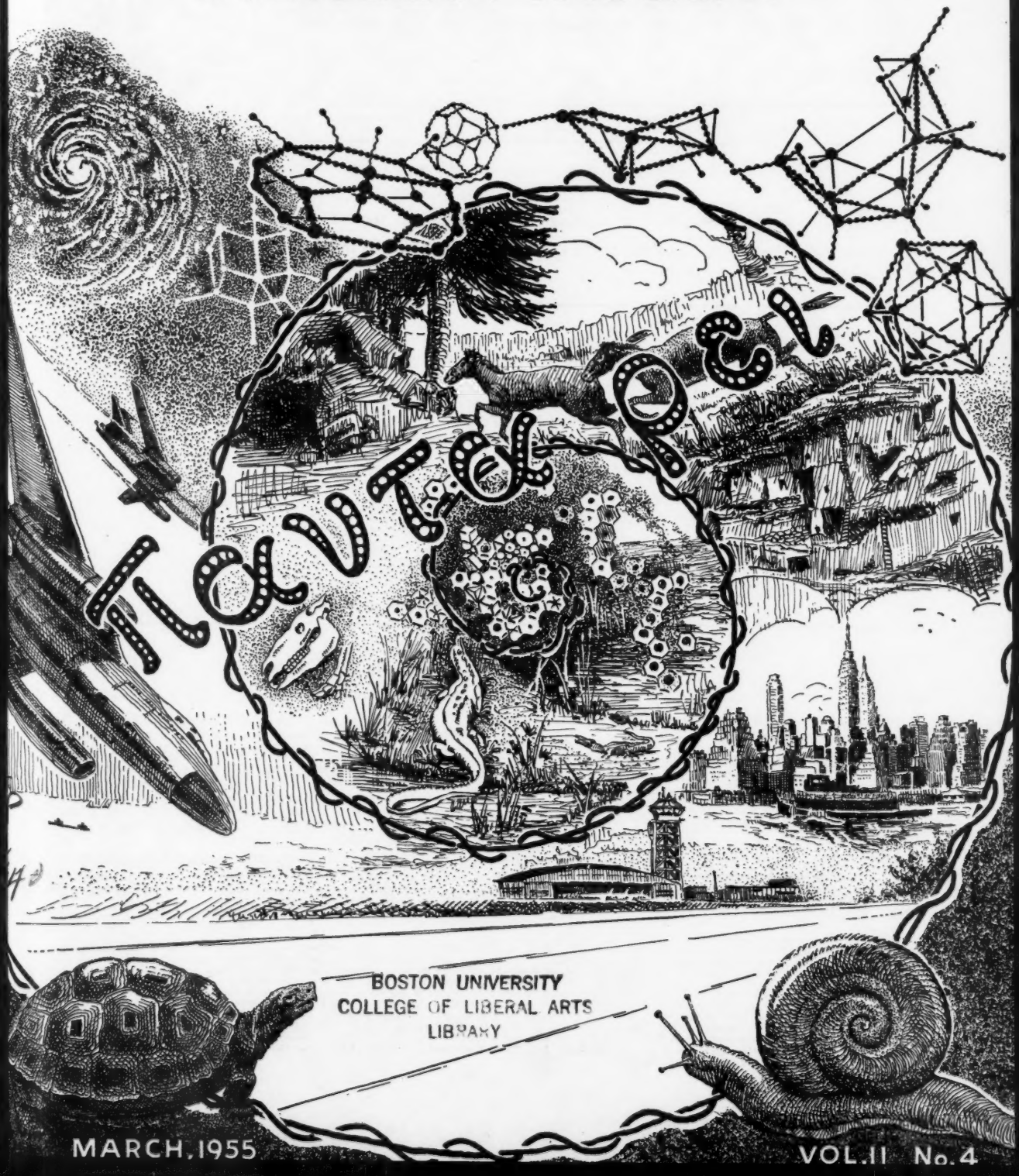
It is significant that a famed British physicist should be convinced that a breakthrough in quantum physics, biology and holistic psychology is imminent. A synopsis here of some of the sub-titles which he gives to his chapters may indicate the thesis of the book: "The conflict of atomism and holism is overcome in the idea of structure . . . A progressive evolution of micro-structures of increasing subtlety has taken place on earth . . . Life may be regarded as the spreading of a pattern as it pulsates . . . Only a science of formative process can provide an adequate picture of man . . . The plan simplifies, records and facilitates its pattern of activities . . . All man's constructive, inventive and creative activities arise from the plastic activity of his brain . . . Beauty is in the forming power."

Dr. Whyte could well be speaking of almost any phase of modern life, and particularly of modern departmentalized education, in his chapter "His [man's] Present Wrongheadedness," which he sub-captions with a quotation from John Donne, "It is all in pieces, all coherence gone." He points out that the quotation from Donne "expressed his sense of the collapse of the hierarchical scholastical world of the Middle Ages," and continues, "in our own time there may be equal time for distress. The art and literature of this century reveal what many feel in their hearts: that man has lost his faith in everything." The experience of lost faith and lost direction is not new, because it is inherent in life that we should not be able completely to understand the parallel processes of growth and decay, but somehow the question "wherein shall mankind place its trust," must be answered if mankind is to go forward. The author believes that some answer can be found somehow within the next half century and hopefully states that " . . . if a reasonably adequate consensus of conviction on certain basic matters emerges there can be a recovery of initiative and hope." He reminds us that "the men who are going to rule the world in AD 2000 will be receiving their education in 1975, only twenty years hence." This brings home to those who are training the teachers of tomorrow the importance of their task for the future of the human race. His thesis is further carried forward in this telling paragraph, "One conclusion seems unavoidable: that the central element in any unification of knowledge and in any restoration of the continuity of the human vital impulse with rational thought must lie in the intellectual and personal recognition of a universal tendency toward form. This essay is one element in a continuing attempt to develop that idea and classify its implications."

Not only is this book stimulating reading, but this reviewer has found it provocative to a class of students in a junior college. Here we have used parts of this essay as a means of stretching the minds of young students to view afresh subject matter which persists in settling itself down into the comfortable cliches of this time, which the student presumes to be "fact." Such material by authors like Dr. Whyte may well be the catalyst to creative insights among the adults of the imminent future. *—Harvey W. Culp*

MAIN CURRENTS

IN MODERN THOUGHT



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AIMS OF THE FOUNDATION FOR INTEGRATED EDUCATION

The Foundation is incorporated under the laws of the State of New York as a non-profit educational organization. Contributions are tax deductible.

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2. To assist teachers to understand and use such materials, and to develop an active, realistic, comprehensive philosophy which will communicate to their students the unity, coherence, and beauty of the world in which we live.

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